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AUTHOR Yates, Christopher
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ABSTRACT

Perhaps the most significant development in microcomputer technology over the last two years has been the development of desktop publishing techniques. This technology promises to offer some significant advantages to institutions developing instructional materials in less developed countries, particularly in terms of control, cost effectiveness, and quality of output. The first section of the paper describes desktop publishing technology and hardware and software requirements for use of the technology. In the second section, the use of desktop publishing at the Open Learning Institute in British Columbia is described, with an emphasis on its effects on the course development process. Consideration of costs and efficiency is followed by a discussion of the technology's quality in terms of speed, size of output, and resolution. The importance of training for users of desktop publishing in developing countries is underscored, and considerations for hardware and software selection are reviewed. (8 references)
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The Design and Development of Educational Materials using microcomputer technology in Distance Teaching Institutions: some issues for consideration

Christopher Yates
International Extension College, London UK

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Abstract

This paper discusses some of the issues associated with the
application of microcomputer technology in distance teaching
institutions. It focuses on the use of desk-top publishing
technology in the developed world and attempts to highlight some
of the lessons learned. It suggests that there are likely to be
considerable benefits to institutions preparing educational
materials in the Third World but potential adopters should
consider the implications fully before committing themselves to
technology driven solutions.

Postal Address:

Christopher A. Yates
International Extension College
Room 105, 17, Russell Square
London WC1B 5EA

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**The Design and Development of Educational Materials using
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Institutions: some issues for consideration**

Christopher Yates
International Extension College, London UK

In distance teaching institutions course development is sometimes regarded as the least predictable of all the activities which take place, partly because of the long time scale over which materials are often prepared. The planning, design and development of instructional materials can take 6 months to 3 years to complete. The application of microcomputer technology to this process in developed countries has been shown to effectively reduce lead times, making the production of course texts more cost effective and predictable, without necessarily sacrificing quality. Perhaps the most significant development in this area over the the last two years has been the emergence of 'desk-top' publishing techniques. This technology promises to offer some significant advantages to institutions working in less developed countries, particularly in terms of control, cost effectiveness, and quality of output. This paper explores some of these issues in the context of distance learning.

What is desk-top publishing?

The desk-top publishing (DTP) process involves three stages (i) the creation of text and or graphic inputs which are keyed into a microcomputer and can be displayed onscreen (ii) the arrangement of the information on pages and (iii) the outputting of these page layouts via a laser printer to produce hard copy.

A typical hardware configuration for a DTP system might consist of a number of input devices for example an image scanner or optical character reader, a keyboard and mouse, a microcomputer with its processing, storage and display facilities and an output device like a laser printer or phototypesetter. Prospective users also need a minimum of three types of software in addition to the operating system software. First, a wordprocessing package like Macwrite 2.0, MicrosoftWord 4.0, or Wordperfect 5.0. Second, a graphics program like Macdraw 2.0, Superpaint or GEM Paint and GEM Draw, and third a page layout program like Pagemaker 3.0 or Ventura Publisher.

Here in London a number of educational projects are currently using this technology to produce in-house publications and curriculum materials. Examples include the new General Certificate of Secondary Education (GCSE) mathematics scheme and the part-time Post Graduate Certificate in Education (Secondary Mathematics) being developed at the Institute of Education, University of London. The Open University the country's largest educational publisher, is presently developing its in-house electronic publishing strategy for the next decade (Bacsich, 1988). This is not to suggest the technology is only for Universities or professional Publishing Houses in developed countries. One of Bhutans' national newspapers, **Kuensel** is currently being produced using state of the art DTP technology (Mehra, 1988).

Nonetheless it is a matter of some debate whether the quality of the output produced through DTP will be pedagogically acceptable, when compared with conventional typesetting output.

Course Creation at the Open Learning Institute - British Columbia

One of the first distance teaching institutions to employ microcomputer technology in the production of course materials was the Open Learning Institute (OLI) in British Columbia Canada. Here courses are written by small teams consisting of three or four persons. In 1985 Microcomputers were installed in the offices and homes of the course writers. The computers were networked and were linked to a minicomputer at OLI (Timmers and Mugridge, 1986).

By this means courses were created electronically. This localised networking has also been successfully mediated internationally. OLI academics working in collaboration with counterparts in Britain's Open University created a mathematics course which was subsequently assessed by an academic residing in the University of British Columbia in Canada. The whole process was negotiated electronically without the need for any party to meet face-to-face.

The new technology had several effects on working practices. Firstly, it reduced the lead time taken to develop courses. Secondly, it increased the degree of flexibility enjoyed by the course team and the production personnel which led to a whole new range of ways to exploit the technology. For example

1. The nature of course writing was altered.
2. Writing, revision and editing were stimulated and simplified.
3. The development time for chemistry courses dropped from 120 to 50 minutes per page.
4. Compared with the typewritten manuscripts, the production unit required less time to produce microcomputer generated manuscripts.

A further innovation resulting from the introduction of microcomputer based systems at OLI were design templates. These were developed to facilitate the standardisation of house style. The templates were stored in the computer memory and thus offered guidelines on the layout, structure and style of the units.

The technology offers three main advantages, primarily to do with the speed and control of production. First the author can express her thoughts on screen vividly and with increased clarity. Second, it allows immediate feedback on how the publication will look, and thirdly the output is ready for immediate distribution (after binding) to the learners. A number of important issues are raised by the application of this technology. Issues associated with cost, quality and control.

Questions of costs and efficiency

Computers can do much to facilitate inter-institutional collaboration in the development of distance learning texts, particularly through the use of international networks like BITNET and EARN, for file transfer (electronic mail) and computer conferencing technologies (Castro 1988). Computer generated graphics, slides and other kinds of digitised images such as those stored on 'Hypercard stacks' could be shared between collaborating institutions. This would be particularly useful in the fields of science and technology. However the direct transfer of graphic images over telephone lines is more problematic than the movement of text. Unfortunately at the moment very few people in third world countries have access to such networks. Nevertheless once the initial investments in the technology have been made cost savings could be very significant.

Improving quality : the front end

It is important to point out that computers enable writers to separate the structure of a document from its content. They also offer authors a great deal of flexibility, particularly for making changes. Universal elements can be saved and used as required eg., page templates created in a page layout program like Pagemaker can be stored and used as and when required.

Powerful wordprocessing software like Microsoft Word give authors considerable help in achieving consistency with facilities like multiple fonts, variable point sizes, powerful in built dictionaries and spell checkers. Facilities also exist to check word spacings, make word and paragraph counts, and carry out regular page previews to check layouts.

Some Output Quality Considerations

The quality issue has academic, aesthetic and pedagogic dimensions. One of the main technical considerations relates to the resolution capabilities of the output devices and the effect on legibility and readability.

Quality - Speed and Size of output

The speed of output from most laserprinters ranges between 8 and 10 A4 sheets per minute depending on the density of the information contained on the page (the more information on the page eg., complex graphics, the slower the printer). This is not fast by conventional publishing standards and if a distance teaching institutions print unit has a large daily throughput to meet, then the performance and speed capabilities of these output technologies may be an important limiting factor. It would seem sensible in many instances to use laser output as input for offset litho printing. In addition most laser printers currently only offer A4 size output though A3 size output is assuredly just around the proverbial corner.

Quality - Resolution

Laser writer output quality for many printers does not exceed 300 dots per linear inch (dpi). If one compares this with the 1,000-25,000 dpi of professional phototypesetters then there is an obvious qualitative difference in terms of resolution. However, as far as we are aware there has not yet been any research to suggest such differences impair the readability of materials produced with 300 dpi technology.

Most laser printers will print characters having point sizes of between 3 and 255. Several families of typefaces are available which makes the system very versatile.

Shifting the locus of control

When computer based systems are used to create materials the locus of control over the process shifts closer to the originator (the author or instructional designer) of the materials and away from the publisher. However, the obverse side of this coin is that skills associated with these jobs tend to become concentrated in the hands of fewer people. In some cases the availability of the technology leads people to take on tasks for which they have inadequate training or insufficient experience eg., graphic design, typographic layout. In some instances people are expected to be able to carry out such tasks efficiently without being given the necessary training or support to do so. This is a serious problem. The cost of the hard and software is budgeted for, but the cost of training is frequently ignored or overlooked. The substitution of capital for labour in developing countries is an issue that has been considered many times before in the context of new technologies. The ramifications of this are far reaching and at this point, beyond the scope of this paper.

Hardware, Software, Towhere ?

IEC consultants working in developing countries have noticed a growing level of interest in the potential and application of microcomputers for course creation and student administration. Many potential users want to know which hardware and software they should choose for their respective needs and what will be the implications of the decisions they take.

The first thing to say is that institutions should first make sure they know what they want to be able to do, before they select their systems. A thorough situational analysis is an essential prerequisite to any adoption. Define what you want to output and to what standard. For example an institution may want to produce documents and course units that include personalised line graphics and scanned digitised photo images in text files. If this is case they should avoid the cheap end of the market, like the Amstrad PCW. These technologies are fine for text only files but they offer a limited graphics capability. Such technologies also often require you to use typesetting codes that are not WYSIWYG (what you see is what you get) which is particularly important for the preparation of technical documents containing formulas and equations (Hazewinkel 1987). In addition some of the recent DTP software for the Amstrad eg., Pagability by Migent, although cheap at £199, does not offer Postscript support (see below). Such machines are based on original IBM first generation technology of 1981 vintage. By today's standards such systems have low power and poor upgradability.

Generally speaking, the more sophisticated the requirements (in terms of resolution, colour, upgradability, and connectivity etc) the more expensive the system required. Time taken specifying requirements accurately, and researching the present and future availability of software, eg., in different languages, would be time well invested.

Unfortunately people working in developing countries do not have easy and rapid access to recent technical information and support. Often their primary considerations understandably concern costs and locally available knowledge and expertise. Often what your used to is what is best (WYUTIWIB). Individuals often have a disproportionate influence over policy formulation and decisions once taken in this area, are hard to change. Systems that can provide cheap international support at the operational level are needed.

There are however, a number of general comments regarding standardisation that may serve as useful guidelines.

The technology now exists to facilitate DTP processes on a wide variety of microcomputer hardware including those that run on both MS or PC DOS and OS/2 based operating systems and those running on the Apple Macintosh computer. It is also relatively easy to transfer files between IBM DOS based operating systems and

Macintoshes using software like TOPS and Appleshare (Michel, 1988). The connectivity compatibility issue is less of a problem than it was a short time ago.

Secondly, the current industry standard for page description language (PDL) is undoubtedly Postscript - any computer or outputting device that will not run Postscript PDL drivers is unlikely to be much use to a distance teaching unit in the future. Those that lack a PDL be it Postscript or any other, will face a number of difficulties including

- severe font limitations
- difficulty in accessing industry fonts
- less flexibility in terms of outputting devices

Thirdly, graphical digitisers and image scanners have been boosted by the adoption of the tag image file format (TIFF) as the market standard (Wilson-Davies, St John Bate, Barnard, 1988).

If hard and software compatibility and connectivity continues to improve and become more readily available as costs fall, the standardisation of communication protocols and computer practices could offer considerable advantages to those in the Third world who are yet to experience the delights and power of the mighty micro.

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